

Thermoelectric Microcoolers for Thermal Management Applications

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Due to the combined increase in circuit integration and chip power dissipation, there is a rapidly growing demand for solving the thermal management issues of power microelectronics. We are pursuing a novel thermal management approach that actively cools only the key high power devices by using a novel thermoelectric microcooler located under each of these power devices. In this way the device can operate at temperatures at or even below the ambient temperature of the heat sink, resulting in an increased reliability and efficiency. To successfully handle the high heat flux densities generated at the back of the power chips, a microcooler with very thin legs and low thermal resistances at the interfaces must be built. We are currently developing a thermoelectric microcooler combining thick films of Bi_2Te_3 -based alloys and very high thermal conductivity substrates, such as CVD diamond or AlN.

Electrochemical deposition is a very attractive process for depositing thick films of compounds semiconductors on metallic surfaces. This paper presents recent results on the deposition of Bi_2Te_3 and related ternary solid solutions on a variety of metallic substrates. We also report on the development of Cu diffusion barriers for Bi_2Te_3 and stable metallizations and diffusion barriers for diamond and AlN substrates.

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